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ABSTRACT

This study built on a 2001-02 classroom observation study of Washington K-12 and technical schools that identified the extent of constructivist teaching activity. Results from classroom observations found that strong constructivist teaching was observable in 17 percent of the classroom lessons. The other 83 percent of the lessons observed may have contained some elements of constructivist teaching, but up to one-half had very little or no elements of constructivist teaching present. More constructivist teaching appeared to occur in alternative schools and integrated subject matter classes. There appeared to be no differences among elementary, middle/junior, and high schools in the degree to which constructivist practices were used. This study explored the relationship of this practice to student achievement, examining the percent of variance in student achievement accounted for by constructivist teaching beyond that contributed by low-income. Data came from the original observation study and from school-level standardized test scores of 4th, 7th, and 10th graders. Results found large correlations between study variables (a negative correlation between school-level family income and student achievement, large positive correlations between constructivist teaching and student achievement, and a negative correlation between constructivist teaching and school-level family income). (SM)

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Constructivist Teaching and Student Achievement: The Results of a School-level Classroom Observation Study in Washington

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Constructivist Teaching and Student Achievement: The Results of a School-level Classroom Observation Study in Washington

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A Technical Report For
The Washington School Research Center

Washington School Research Center

Foreword

In 2000 the Bill & Melinda Gates Foundation began an education initiative in Washington State that centered on school reinvention with the goal of improving student learning. As part of that initiative third party evaluation teams have been monitoring the process and progress of reinvention and collecting various forms of data from the schools. During the 2001-02 school year one of these teams conducted an extensive classroom observation study in 34 schools to determine the degree to which "powerful teaching and learning" (also called constructivist teaching or authentic instruction) was present in the schools. The findings from that study were presented in a descriptive report and showed that this form of teaching was present in about 17 percent of the classrooms they observed. The data from that classroom observation study have been provided to the Washington School Research Center for further analysis, resulting in this technical report on the relationship of constructivist teaching to student achievement.

The findings presented here are at the same time instructive and disturbing. The relationship between student family income and student achievement is expected and a consistent finding in virtually all studies using aggregated school-level data. The strong relationship between constructivist teaching practices and student achievement is somewhat surprising, given the aggregated nature of the data used in the analyses. From a theoretical perspective the state essential learnings, WASL assessments and the theoretical model of constructivist teaching used in the observation study appear to be very complementary, and these data support that model. This finding suggests that Washington schools should consider the potential advantages of these instructional practices.

Critics of American education have claimed that children living in poverty often receive an inferior educational experience. Unfortunately, at least in this sample of schools, the relatively strong negative correlation between school-level student family income and constructivist teaching shows that students in schools with lower levels of student family income receive less intellectually demanding instruction and less instruction of the type that is a predictor of academic success than do students in schools with higher levels of family income. This finding should be concern to all of us as we work to improve education in this state.

Jeffrey T. Fouts
Executive Director

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Constructivist Teaching and Student Achievement: The Results of a School-level Classroom Observation Study in Washington

Introduction

A classroom observation study was conducted in the 2001-2002 school year among a selection of Washington schools to identify the extent of constructivist teaching activity. While the findings of this study were informative in pointing out the nature and extent of the kind of teaching that occurs in schools, it was important to see whether the findings could predict school-level student achievement in schools that varied by low-income.[1] Prior research suggests that constructivist teaching (and other school-level attributes) has an impact on student achievement.[2] But can constructivist teaching predict school-level achievement beyond the effects of low-income?

The Classroom Observation Study

The classroom observation study was part of the on-going program evaluation of the Bill & Melinda Gates Foundation's Model Schools Initiative and Model Districts Initiative in the state of Washington. A complete description of the study and results is provided by Fouts, Brown and Thieman (2002). The study used the Teaching Attributes Observation Protocol (TAOP), which is based on a conceptual framework of constructivist teaching and learning. The TAOP contains seven lesson components and a number of indicators under each component. The content validity of the instrument was checked against the literature and existing observation instruments.

Following an extensive training period, classroom observations were conducted in 669 classrooms from 34 schools over a four month period of time. The sample of schools consisted of 15 elementary, eight middle/junior high, nine high, and two technical schools. The study was designed to provide for a representative sample of classrooms drawn from social studies, mathematics, science, and language arts/English classrooms. The number of classrooms observed at a school ranged from 6 to 54 classes, depending on the size of the school. Provisions were made for continual checks for inter-rater reliability and agreement, and the results suggest that there was a high degree of consistency in the rating process.

The general findings of this study were that strong constructivist teaching was observable in about 17% of the classroom lessons. The other 83% of the

[1] Low-income was measured by the percent of students at a school who are eligible for compensatory funding.
[2] Wilson, et al., 2002.

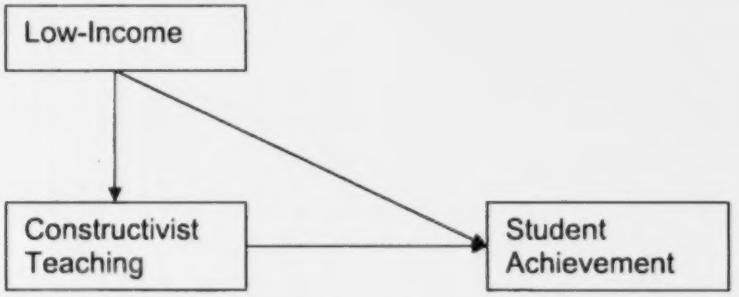
lessons observed may have contained some elements of constructivist teaching, but as many as one-half of the lessons observed had very little or no elements of constructivist teaching present. More constructivist teaching appeared to take place in alternative schools and in integrated subject matter classes than in traditional schools or subjects. There appeared to be no differences among the elementary, middle/junior high and high schools as to the degree to which constructivist practices were used.

While this classroom observation study provided a general description of the degree to which constructivist practices were employed in the schools, the relationship of this practice to student achievement was not explored. To determine the degree of that relationship is the purpose of this report.

The Model Tested

Because of the potential overlap of low-income (LI) and constructivist teaching activity (CT) by school, we proceeded with an incremental partitioning of the variance among the study variables. The following model posits direct and indirect effects of LI on achievement (A) and direct effects of CT on A:

Model 1 – Direct and Indirect Effects of Low-Income and Constructivist Teaching on Student Achievement



The goal of this analysis was to understand the percent of variance in student achievement accounted for by constructivist teaching beyond that contributed by low-income. Previous studies[3] have noted the substantial impact of low-income on student achievement in Washington. This study proceeds from that research by attempting to document the incremental variance contributed by constructivist teaching.

[3] For example, Abbott and Joireman, 2000.

The Nature of the Data

Data used in this analysis were gathered from two sources. First, the classroom observation data were obtained from the researchers who conducted the observation study. The TAOP provides seven lesson component scores and a holistic score on the overall degree of constructivist instruction for each lesson. This holistic score for each classroom observed was aggregated for each school, providing a school-level constructivist teaching score. These scores provided the measure of the degree of constructivist teaching practices at the school.

The second source of data was the school-level WASL scores of 4th, 7th, and 10th grade students in Washington provided by the Office of Superintendent of Public Instruction. School scores indicated the percent of the students who passed the writing, reading, and mathematics sections of the WASL administered in 2002.[4] Schools designated "Alternative schools" were not included in the final analysis since they represent different classroom arrangements. This resulted in a final sample of 28 schools used in the following analyses.

Each of the 28 schools was assigned three achievement (writing, reading, and mathematics) scores according to the appropriate grade level of the school. In a few instances, schools that had scores for both 4th and 7th grades were assigned scores depending on the size of the grade levels. Standard scores (z) were created for the grade-level scores for greater comparability across school levels.

Findings

Table 1 shows the descriptive statistics of the variables used in the analysis.

Table 1

Descriptive Statistics

	Mean	SD
Writing (z)	0.47	0.83
Reading (z)	0.33	0.89
Mathematics (z)	0.43	1.07
Constructivist Teaching (z)	-0.21	0.84
Low-Income (z)	0.06	0.97
N=28		

[4] % passing included students achieving Level 3 and 4 on reading and mathematics, and Level 4 on writing.

Table 2 shows the zero order correlations among the study variables. An inspection of the correlations shows that low-income is correlated inversely with all of the other study variables, including achievement. This was expected given the findings of other studies involving low-income and achievement (see earlier note). Also important to note however, is the significant inverse correlation between low-income and constructivist teaching (-.54). This is a general indication that schools that have more low-income students also have lower constructivist teaching scores. The correlations among CT and achievement variables were strong and positive.

Table 2

Correlations Among Study Variables

		1	2	3	4	5
1	Writing	1				
2	Reading	0.90	1			
3	Mathematics	0.86	0.93	1		
4	Low-Income	-0.82	-0.89	-0.87	1	
5	Constructivist Teaching	0.61	0.65	0.62	-0.54	1

(All correlations are significant at or beyond the .01 level)

The second part of the analysis was the incremental partitioning of the variance according to Model 1, given the level of inter-correlations among the study variables. In this analysis, the increment of variance in achievement accounted for by constructivist teaching beyond that contributed by low-income was determined by the following formula:

$R^2_{1.23} - R^2_{1.2}$ (1=A; 2=LI; 3=CT)

The first part of the formula is the entire regression model, and the second part is the regression of achievement on low-income. Applying this formula is equivalent to the squared semi-partial correlation of constructivist teaching and achievement, beyond the influence of low-income.

Table 3 shows the results of the regression analyses for average school-level writing, reading, and mathematics scores. In each case, the results for the omnibus test (R^2 and F-ratio) are given, along with the contribution of CT to achievement beyond the effects of low-income. When low-income is accounted for, CT contributes between 3% and 4% of the variance in achievement. Taken together, these results indicate positive but small effects of constructivist teaching on school-level achievement beyond the contribution of low-income.

Table 3

Contribution of Constructivist Teaching to Achievement, Accounting for Low-Income

Achievement	Overall R^2 (Adj.)	Overall F Ratio	Unique Contribution of CT[1]
Writing	.683	30.111, p<.001	.04
Reading	.824	64.143, p<.001	.04*
Mathematics	.774	47.261, p<.001	.03

[1] Unique Contribution of CT is indicated by the squared semi-partial correlation

*(p<.05)

Discussion

The most notable findings in these analyses are the large correlations between the study variables. The negative correlation between school-level family income and student achievement was expected. The large positive correlations between constructivist teaching and student achievement are noteworthy, as is the negative correlation between constructivist teaching and school-level family income. The regression analyses show that constructivist teaching does predict student achievement beyond the effects of school-level family income, albeit with a greatly reduced effect.

While the unique contribution of constructivist teaching to achievement is small, there are several observations that can be made about the findings. First, school-level analyses of this sort often indicate that low-income has a dominant influence on student achievement. In an earlier study in Washington State researchers found that "the only variables that were significant predictors of WASL scores were aggregate demographic factors" (Stecher & Chun, 2001, p. 23). This being the case, it is perhaps noteworthy that constructivist teaching predicts additional variance in achievement, given the nature of the data used in these analyses.

Second, aggregate constructivist teaching scores are more inclusive of academic subjects than aggregate WASL scores. The constructivist teaching score is a gross measure of the type of instruction occurring in a variety of classrooms, whereas WASL assessments target math, reading, and writing specifically. In this sense, the aggregated constructivist teaching scores represent an *overall* instructional score of several disciplines and are not limited to reading, writing, and math. One might theorize that the aggregated observation ratings in only math and language arts classrooms might be stronger predictors of the corresponding WASL scores. In this study, these analyses were not possible because of the small number of classroom observation scores in some of the math and language arts classrooms for some schools.

Third, 7th and 10th grade success on the WASL may be due to the cumulative effects of instruction received in prior years, rather than the type of instruction received in the present or year before the WASL assessment. Therefore, any effects of current instructional practices would be expected to have only a limited impact.

Fourth, the correlations may be affected because of a restriction of range in both the test scores and the classroom observation data. The classroom observation researchers noted that the variance within a school was much greater than among schools. This statistical limitation has the effect of reducing correlations. For these reasons, the scores might underestimate the importance of constructivist teaching, particularly given the strong zero-order correlation and the nature of the intellectual activities and student performance required for success on the WASL.

Finally, the negative correlation between constructivist teaching and student family income points out that, for whatever reason, students in schools with lower levels of student family income receive qualitatively different instruction than do students in schools with higher levels of family income. Specifically, they receive less constructivist teaching, and as measured by the TAOP, this means less intellectually demanding instruction. This finding warrants further exploration and attention.

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